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SUMMARY ACCOUNT OF DEVONIAN SECTIONS MILE 390 TO MILE 520 ALASKA HIGHWAY

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Figure 2.--Devonian Formations, Mile 390 to Mile 520 Alaska Highway.

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FIGURES

Figure 1.—Distribution of Devonian fossils, Mile 290 to Mile 320 Alaska Highway.

Figure 2.—Paleozoic formations, Mile 290 to Mile 320 Alaska Highway.

SUMMARY ACCOUNT OF DEVONIAN SECTIONS

MILE 390 TO MILE 520 ALASKA HIGHWAY

INTRODUCTION

The Devonian strata of northeastern British Columbia contain important reserves of natural gas. The natural gas accumulations are found in the subsurface of the Interior Plains, and have been discovered in the Clarke Lake, Kotcho Lake, and Petitot River fields. The gas is entrapped in vuggy, dolomitized reefs. The reefs do not have any obvious or simple pattern of distribution, and much of the stratigraphy of the gas accumulations and reefs is obscure.

Studies of Devonian stratigraphy are in process by the Department of Mines and Petroleum Resources. These follow two lines: (1) investigations of Devonian strata in outcrop and (2) subsurface stratigraphy and mapping, from drill cuttings, cores, and geophysical logs. Devonian strata outcrop in the Rocky Mountains, where they have been examined in exposures accessible from the Alaska Highway. Such field studies were carried out in 1961 and 1962, and the following account summarizes the results of this work.

The area of study lies across the northern extremity of the Rocky Mountains, and includes the adjacent part of the Liard Plateau, Figure 1. It extends from latitude 58 degrees 40 minutes north, longitude 124 degrees 30 minutes west to latitude 59 degrees 40 minutes north, longitude 126 degrees 30 minutes west, that is, from Mile 390 to Mile 520 of the Alaska Highway.

Devonian strata in this area were first reported by M.Y. Williams from reconnaissance (1944). L.R. Laudon and B.J. Chronic reviewed the Palaeozoic succession (1947) and also published their interpretation of the Devonian stratigraphy (1949). A small part of this area in the Liard Plateau is covered by the preliminary map of H. Gabrielse (1961).

The writer is indebted to Drs. D.J. McLaren, A.W. Norris, E.T. Tozer, and E.W. Bamber of the Geological Survey of Canada, for identifications of fossils and their dating. Dr. D.L. Griffin accompanied the writer for most of the field work in 1961. Mr. F.N. Fenger served as field assistant in 1962. In 1961, eight weeks were spent in the field, and twelve weeks in 1962.

Devonian strata form the major outcrop in the eastern ranges of the Rocky Mountains--the Stone and Sentinel Ranges. The two ranges are composed of thrust blocks. They are 12 miles apart, and are separated by the Racing River synclinorium. This structure exposes mostly strata of Triassic to Mississippian age. Younger Devonian strata occur in valleys transecting this structure. The writer has measured and described representative sections at ten localities, from the field work, 1961 and 1962. Those

which are most complete and suitable for study are: (1) a section at One Ten Creek, north of the Alaska Highway, at Mile 398, in the Stone Range; (2) sections at One Fifty Creek, Mile 433; (3) sections on the west slope of the Sentinel Range from Mile 465 to Mile 475. Most of the Devonian succession is exposed at the section in One Ten Creek in the Stone Range. At other localities, the succession is incomplete, and the stratigraphy is therefore obtained by correlating and adding several sections. Only such composite and generalized sections are treated here. They are described for the Stone and the Sentinel Range further west, and illustrated in Figure 2.

Stratigraphic units distinguished in this report are of formational rank and require to be named. However, they are assigned temporary titles in view of the unsuitability of the stratigraphic units and terms already applied to Devonian strata in this area, and in view of current changes in stratigraphic names. New formational names are intended for the lower five units of this report.

STRATIGRAPHY

The Devonian succession contains, in the lower part, a sequence of dolomites with a middle interval of sandstones. The dolomites are followed by limestones which in turn are overlain by shales ranging from Middle Devonian to Mississippian age. Much of the strata are poorly fossiliferous; the dolomites are particularly barren. The Devonian succession is thick, about 3,250 feet in the Stone Range to about 5,000 feet in the Sentinel Range. The same stratigraphic units persist from east to west, with the exception of the sandstones, Figure 2.

The Devonian strata are underlain by dolomites and sandy dolomites with stromatoporoid beds and corals. These dolomites are of Silurian age, from the identifications of fossils and advice by Norris (1962).

UNIT G.--This formation consists of aphanitic dolomites. The bedding is regular, with a gradation or alternation of grey and dark grey dolomite in each bed. The beds are separated by thin argillaceous partings. A few thin bands and lenses of brown chert are present in some places. The lower 60 feet of the formation contains grey, sandy and silty dolomites. The base is marked by sandstone partings and lenses, and the formation rests on a wave-cut surface of the Silurian dolomites. The contact represents a disconformity. In the Sentinel Range the formation is 1,475 to 1,235 feet thick. The variation in thickness is due to the gradational and interfingering contact with the overlying Unit F. The formation is 275 feet thick in the Stone Range. This thinning is attributed to reduced sedimentation and to erosion and truncation by Unit F to the east.

The formation is assigned a tentative early Devonian age. Correlative strata in the Rabbit River map-area yielded fish remains of this dating according to Gabrielse (1961).

UNIT F.--The formation includes beds above the dolomites of Unit G and below sandstones of Unit E. Where the sandstones of Unit E are absent or poorly developed, Unit F then occupies the interval between dolomites of Units G and D. The latter definition applies to the northwest part of the Sentinel Range, north of Muncho Lake.

Unit F contains: grey, greenish, brownish, and buff coloured dolomites; dolomite and dolomite-limestone breccias of various colours; thin argillaceous partings; sandy and silty limestones, which may be brecciated; together with few shale beds in places. The degree of dolomitization and brecciation is variable. The outcrop is obvious from buff weathering colours, light coloured clay residues, and its recessive topography.

In the northwest part of the Sentinel Range, the Units G and F form a continuous sequence. The base of Unit F is drawn arbitrarily, at the first full development of limestones or breccias. The thickness was found to vary between 410 and 590 feet, according to the definition of the base. The formation is divisible into two members in this local area: (i) an upper member distinguished by interbeds of sandy limestones and dolomites; (ii) a lower member lacking important beds of sandy carbonates. The upper member (i) is correlated with the sandstones, Unit E.

Unit F is 100 to 105 feet thick in the Stone Range. Here, the lowermost bed consists of a dolomitic sandstone 3 to 4 feet thick. Its base truncates the underlying dolomites of Unit G at a slight angle, and is considered to represent a local disconformity.

UNIT E.--The formation is well developed in the east. It consists of clean quartzitic sandstones with a dolomite matrix. The lower and upper boundaries are narrow gradations of sandy dolomites with sandstone partings.

The formation is 100 to 105 feet thick in the eastern section, in the Stone Range. The thickness decreases westward to less than 60 feet, near One Fifty Creek in the Sentinel Range. Unit E is not a recognizable unit in the remaining part of the Sentinel Range north of Muncho Lake.

Units E and F lack fossils.

UNIT D.--This term includes a thick sequence of dolomites which are light grey, aphanitic, and massive bedded. They are uniform in appearance and show little variation, other than the amounts of veining and brecciation by coarse crystalline calcite.

The formation is 900 feet thick in the east to about 2,000 feet thick in the west. Fossils are rare; the few collected have not allowed any good dating.

UNIT C.--This unit is composed of dolomites interbedded with limestones and partially dolomitized limestones. Colours vary from light to dark grey, and the texture from aphanitic to coarse crystalline. Veining and brecciation by coarse crystalline calcite is frequent.

The formation is a transition between Units D and B. The thickness varies from 540 to 225 feet or less in the west, where the formation is more poorly defined. The formational boundaries only represent the limits of complete dolomitization, and the virtual absence of dolomitization; they probably do not follow any constant stratigraphic horizons. In the Stone Range, Unit C contains a few reef knolls of stromatoporoids, and few scattered algal bodies.

UNIT B.--This term is applied to strata in the interval between shales of Unit A, and the partially dolomitized limestones and dolomites of Unit C. Otherwise where Unit C is not recognized or indistinct, the lower limit of Unit B may be given by dolomites referrable to Unit D. The formation consists of dark grey limestones which are mostly aphanitic and well bedded. The formation is 785 feet thick in the Stone Range, and the thickness increases to about 1,000 feet in the Sentinel Range and Liard Plateau.

Unit B is patchily fossiliferous. Faunas of stromatoporoids, corals, brachiopods, pelecypods, and ostracods collected indicate a general Middle Devonian age. According to Norris (1962) the faunas included: Utaratuia laevigata (Crickmay) which is common in the Nahanni Formation (southern part of the District of Mackenzie); Syringopora sp. D. which is found in Middle Devonian rocks of Western Canada, including beds equivalent to the lower part of the Pine Point Formation (Great Slave Lake region); and Australophyllum hyperbolicum (Crickmay) which is abundant in the Hume Formation (lower Mackenzie region).

UNIT A.--This unit is composed of dark grey shales, siliceous and pyritic shales with few interbeds of calcareous shales. Thin regular bedding is characteristic. The formation is not well exposed, and mostly floors the valleys or underlies escarpments. In many exposures, it is complexly folded, and it represents an incompetent unit in the general deformation of this area.

In the eastern sections, at One Ten Creek and near the Racing River Bridge, the boundary of Unit A and Unit B is drawn at the base of a brachiopod band 8 to 12 inches thick. The fossils are contained in a matrix of black, argillaceous limestone, which is separated from underlying limestones by a bedding break. The brachiopod band may be attributed to Unit A or B. In the Racing River section, rotted, black, argillaceous and crystalline limestones and calcareous shales, with thin shale interbeds, extend 10 feet above the brachiopod band and indicate a passage at the base of Unit A. The fauna of the brachiopod band included:

Lingula cf. L. minuta Meek
Devonoproductus cf. D. sp. D. (: Productus ? Meek 1867)
Atrypa sp.
Atrypa cf. A. asperanta Crickmay
Atrypa asperanta Crickmay
Emanuella ? sp.
Emanuella meristoides (Meek)
Warrenella cf. W. franklini (Meek)
Leiorhynchus castanea (Meek)
Hadrorhynchia sp.

Identifications are by Norris who reports a late Middle Devonian (Givetian) age for the fauna. This fauna occurs in the upper part of the Pine Point Formation of the Great Slave Lake region, and is also widespread in the Mackenzie region (Norris, 1962).

Styliolina sp. and Tentaculites sp. are abundant in shales and limestones overlying the brachiopod band. In the Liard Plateau, in a section 1¼ miles north of the Liard Hotsprings, shales of Unit A follow fossiliferous limestones of Unit B abruptly. The brachiopod band is absent here, and the Tentaculites sp. - Styliolina sp. fauna has not been found.

About 1,000 feet of beds have been included in Unit A. Most of the upper third of the unit is concealed in the eastern sections of the area and has not been seen. The relationship of Unit A to the overlying Kindle Formation is not completely established. The boundary with the Kindle Formation is placed at the first development of siltstones and sandstones with interbedded shales. Shales at the Smith River Bridge contained Goniatites choctawensis Shumard, of late Mississippian age. These shales are referred to the upper part of Unit A, but the exposure is isolated and without any stratigraphic reference at hand.

Under the Plains of northeastern British Columbia the upper Devonian is more than 2,000 feet thick, and comprises a shale sequence with distinct carbonate and clastic formations. The latter formations are absent from the Devonian succession along the Alaska Highway. Unit A is therefore considered to represent sedimentation from Middle Devonian to Mississippian time. It appears to be a condensed sequence, and likely contains several diastems. No disconformities or erosional surfaces have been observed, and other faunas collected from this unit have not proved to be of stratigraphic value.

Beds overlying Unit A are referred to the Kindle Formation. They consist of siltstones and fine sandstones, calcareous siltstones and sandstones together with shales and silty shales, where observed in the Rocky Mountains. They have not yielded fossils suitable for dating. Sutherland (1958) assigned a Mississippian and

Pennsylvanian age to the Kindle Formation in the Foothills. The writer's collections from the Foothills only allowed the general dating of Pennsylvanian to Permian, according to the identifications and advice of Bamber (1962).

REMARKS.--A concept of two formations for the dolomite sequence underlying "yellow sandy to silty limestone beds" (Laudon and Chronic, 1949, pp. 192-193) seems untenable, and it is thought that the terms "Muncho and McConnell Formations," applied to this interval, are best discarded. The earlier name, "Ramparts," for the upper carbonate sequence has dubious standing, and does not distinguish the stratigraphic divisions recognized in this work.

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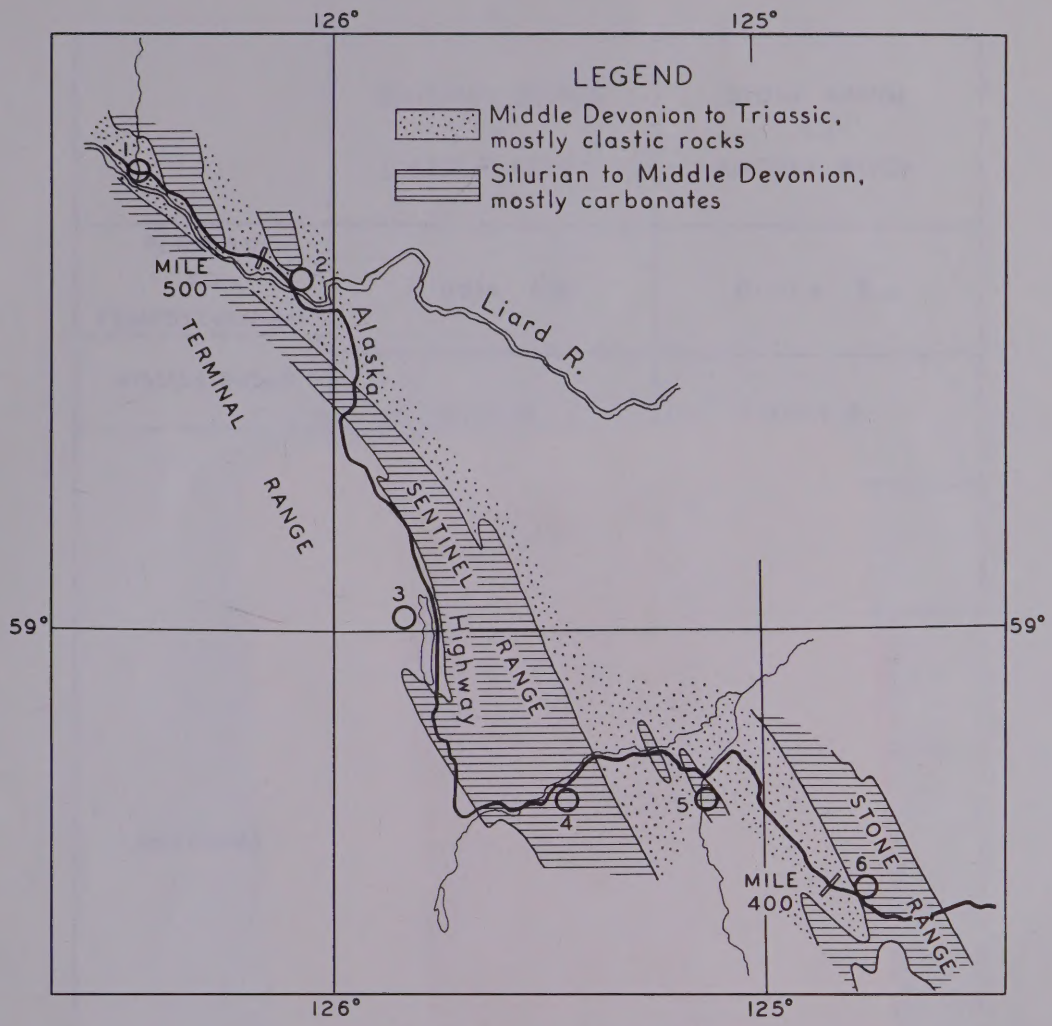

Localities mentioned in text

1 Smith River Bridge
2 Liard Hotsprings
3 Muncho Lake
4 One Fifty Creek
5 Section at the Racing River
6 One Ten Creek(north of highway)

Scale 0 10 20 30 40 Miles

Figure I. Distributions of Devonian Rocks, Mile 390 to Mile 520, Alaska Highway.

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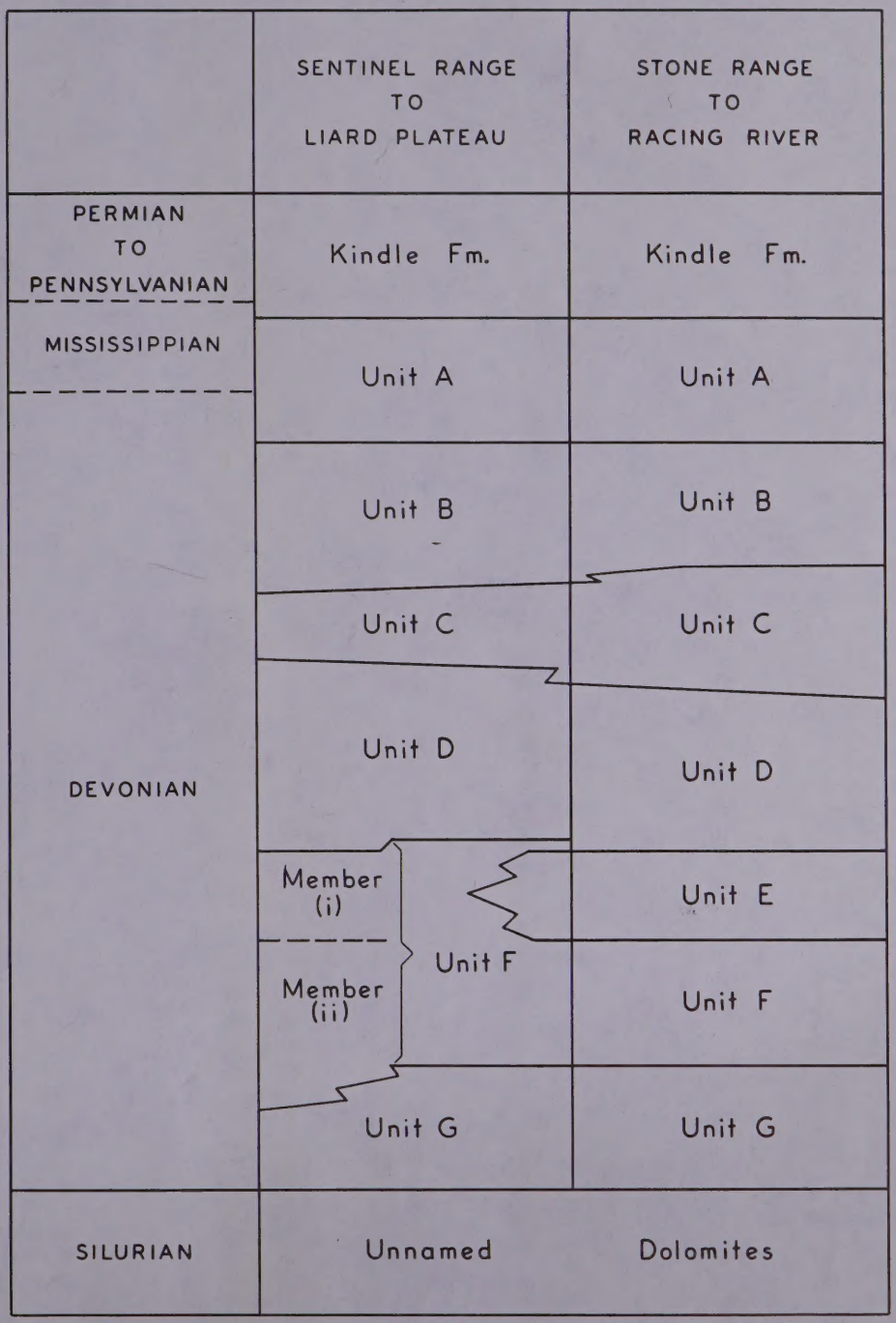

Figure 2. Devonian formations, Mile 390 to Mile 520, Alaska Highway.

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